CLAIMS

1. A combined sensor for measuring oxygen content and NO_X content in a gas, said sensor comprising:

a sensor body disposed in said gas, wherein said sensor body comprises

a plurality of oxygen-porous electrode layers,

a plurality of dissociative oxygen-porous electrode layers, wherein said dissociative oxygen-porous electrode layers comprise a material selected to catalyze dissociation of NO_X into nitrogen and oxygen, and

a plurality of oxygen ion conductive ceramic layers interposed between respective ones of said oxygen-porous electrode layers and respective ones of said dissociative oxygen-porous electrode layers;

an oxygen content electrical signal output coupled to said plurality of oxygen-porous electrode layers; and

a NO_X content electrical signal output coupled to said plurality of dissociative oxygen-porous electrode layers, wherein said NO_X content electrical signal output is electrically isolated from said oxygen content electrical signal output.

2. A combined sensor for measuring oxygen content and NO_X content in a gas, said sensor comprising:

a sensor body disposed in said gas, wherein said sensor body comprises

a plurality of oxygen-porous electrode layers,

a plurality of dissociative oxygen-porous electrode layers, wherein said dissociative oxygen-porous electrode layers comprise sufficient Rh to catalyze dissociation of NO_X into nitrogen and oxygen, and

a plurality of oxygen ion conductive ceramic layers interposed between respective ones of said oxygen-porous electrode layers and respective ones of said dissociative oxygen-porous electrode layers;

an oxygen content electrical signal output coupled to said plurality of oxygen-porous electrode layers; and

a NO_X content electrical signal output coupled to said plurality of dissociative oxygen-porous electrode layers, wherein said NO_X content electrical signal output is electrically isolated from said oxygen content electrical signal output.

3. A combined sensor for measuring oxygen content and NO_X content in a gas, said sensor comprising:

a partial enclosure defining a gas passage;

a sensor body disposed in said partial enclosure, wherein said sensor body comprises

a plurality of oxygen-porous electrode layers,

a plurality of dissociative oxygen-porous electrode layers, and

a plurality of oxygen ion conductive ceramic layers interposed between respective ones of said oxygen-porous electrode layers and respective ones of said dissociative oxygen-porous electrode layers; and

a diffusion barrier defining a diffusion-limited portion of said gas passage, wherein said sensor body is disposed in said diffusion-limited portion of said gas passage.

4. A combined sensor for measuring oxygen content and NO_X content in a gas as claimed in claim 3 wherein said gas passage defined by said partial enclosure defines an inlet portion and an outlet portion and wherein said sensor body extends across said outlet portion of said gas passage.

5. A combined sensor for measuring oxygen content and NO_X content in a gas as claimed in claim 3 wherein at least a portion of said partial enclosure defines an oxygen pumping portion configured to maintain a favorable NO_X to oxygen ratio.

6. A combined sensor for measuring oxygen content and NO_X content in a gas as claimed in claim 5 wherein said predetermined NO_X to oxygen ratio is below about 1:5.

7. A combined sensor for measuring oxygen content and NO_X content in a gas as claimed in claim 3 wherein at least a portion of said partial enclosure defines an oxygen pumping portion, said combined sensor further comprises a feedback loop coupled between said sensor body and said oxygen pumping portion, and said feedback loop is configured to control said oxygen pumping portion as a function of an amount of oxygen sensed by said sensor body.

8. A combined sensor for measuring oxygen content and NO_X content in a gas as claimed in claim 7 wherein said feedback loop is configured to decrease a pump rate of said oxygen pumping portion as said amount of sensed oxygen decreases.

9. A combined sensor for measuring oxygen content and NO_X content in a gas as claimed in claim 3 wherein at least a portion of said partial enclosure defines an oxygen pumping portion comprising:

an oxygen-porous cathode electrode positioned over an interior surface of said partial enclosure within said diffusion-limited portion of said gas passage;

an oxygen-porous anode electrode positioned over an exterior surface of said partial enclosure outside of said diffusion-limited portion of said gas passage; and

an oxygen-ion conductive ceramic material interposed between said cathode electrode and said anode electrode.

10. A combined sensor for measuring oxygen content and NO_X content in a gas as claimed in claim 9 wherein said oxygen-porous anode electrode comprises platinum and said oxygen-porous cathode electrode comprises platinum and gold.

11. A combined sensor for measuring oxygen content and NO_X content in a gas as claimed in claim 3 wherein said plurality of oxygen-porous electrode layers comprise a material selected to inhibit dissociation of NO_X into nitrogen and oxygen.

12. A combined sensor for measuring oxygen content and NO_X content in a gas as claimed in claim 11 wherein said plurality of oxygen-porous electrode layers comprise Pt and Au.

13. A combined sensor for measuring oxygen content and NO_X content in a gas as claimed in claim 3 wherein said plurality of plurality of dissociative oxygen-porous electrode layers comprise a material selected to catalyze dissociation of NO_X into nitrogen and oxygen.

14. A combined sensor for measuring oxygen content and NO_X content in a gas as claimed in claim 13 wherein said dissociative oxygen-porous electrode layer material is selected to catalyze dissociation of NO_X into N_2 and O_2.

15. A combined sensor for measuring oxygen content and NO_X content in a gas as claimed in claim 14 wherein said plurality of dissociative oxygen-porous electrode layers comprise Rh.

16. A combined sensor for measuring oxygen content and NO_X content in a gas as claimed in claim 3 wherein said combined sensor further comprises a power source, said power source is configured such that an oxygen-porous electrode layer and a dissociative oxygen-porous electrode layer define respective ones of an adjacent pair of electrode layers having matching polarity and substantially equivalent electrical potential such that pumping of oxygen between said oxygen-porous electrode layer and a dissociative oxygen-porous electrode layer is inhibited.

17. A combined sensor for measuring oxygen content and NO_X content in a gas as claimed in claim 3 wherein said oxygen-porous electrode layers are electrically isolated from said dissociative oxygen-porous electrode layers.

18. A combined sensor for measuring oxygen content and NO_X content in a gas as claimed in claim 3 wherein said plurality of oxygen-porous electrode layers are coupled to an electrical signal output that is independent of an electrical signal output to which said dissociative oxygen-porous electrode layers are coupled.

19. A combined sensor for measuring oxygen content and NO_X content in a gas as claimed in claim 18 wherein said oxygen-porous electrode layers are coupled to an electrical signal output indicative of an oxygen content of gas within said diffusion-limited portion of said gas passage and said dissociative oxygen-porous electrode layers are coupled to an electrical signal output indicative of an NO_X content of gas within said diffusion-limited portion of said gas passage.

20. A combined sensor for measuring oxygen content and NO_X content in a gas as claimed in claim 3 wherein said partial enclosure comprises an oxygen-ion conductive ceramic tube and said diffusion barrier extends across an inside diameter of said tube defining a barrier between said diffusion-limited portion of said gas passage and an inlet portion of said gas passage.

21. A combined sensor for measuring oxygen content and NO_X content in a gas as claimed in claim 3 wherein said diffusion-limited portion of said gas passage comprises a hermetically sealed zone including a diffusion inlet defined by said diffusion barrier and a sensor outlet defined by said sensor body.

22. A combined sensor for measuring oxygen content and NO_X content in a gas as claimed in claim 21 wherein said hermetically sealed zone further comprises an oxygen pumping portion.

23. A combined sensor for measuring oxygen content and NO_X content in a gas as claimed in claim 3 wherein said diffusion barrier defines a barrier between said diffusion-limited portion of said gas passage and an inlet portion of said gas passage and wherein said combined sensor includes an oxygen sensor positioned in said inlet portion of said gas passage.

24. A combined sensor for measuring oxygen content and NO_X content in a gas as claimed in claim 3 wherein said diffusion barrier comprises a zirconia partition.

25. A combined sensor for measuring oxygen content and NO_X content in a gas as claimed in claim 3 wherein said diffusion barrier extends across said gas passage.

26. A combined sensor for measuring oxygen content and NO_X content in a gas as claimed in claim 25 wherein said diffusion barrier comprises a substantially uniform partition.

27. A combined sensor for measuring oxygen content and NO_X content in a gas as claimed in claim 3 wherein said diffusion barrier is configured to pass an amount of gas that varies as a function of oxygen partial pressure of gas within an inlet portion of said gas passage.

28. A combined sensor for measuring oxygen content and NO_X content in a gas as claimed in claim 3 further comprising a heater configured to elevate an operating temperature of said combined sensor to about 800°C.

29. A combined sensor for measuring oxygen content and NO_X content in a gas as claimed in claim 28 wherein said partial enclosure comprises a zirconia tube and said heater is formed about said zirconia enclosure.

30. A sensor body comprising:

a plurality of oxygen-porous electrode layers;

a plurality of dissociative oxygen-porous electrode layers, wherein said dissociative oxygen-porous electrode layers comprise a material selected to catalyze dissociation of NO_X into nitrogen and oxygen; and

a plurality of oxygen ion conductive ceramic layers interposed between respective ones of said oxygen-porous electrode layers and respective ones of said dissociative oxygen-porous electrode layers.